RESEARCH ARTICLE

Predictability of intrapartum cardiotocography with meconium stained liquor and its correlation with perinatal outcome

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Abstract

Objective: To determine the relationship between the colour of liquor and the trace of cardiotocography to see whether it is reactive or non-reactive.

Methods: This cross-sectional study was conducted at Obstetrics and Gynaecology department, Dar-ul-Sehat Hospital, Karachi from June 2015 to March 2016, and comprised women in labour who delivered singleton babies and had ≥37 weeks of gestation.

Intrapartum monitoring by cardiotocography was conducted. The status of the amniotic membranes, colour and amount of liquor observed were recorded. Cardiotocography was performed for 30 minutes in the left lateral position on admission as well as a monitoring tool in labour at an interval of less than 4 hours. Foetal heart transducer and uterine pressure transducers were applied and the readings were recorded. SPSS 21 was used for statistical analysis.

Results: Of the total 200 subjects, 183(91.5%) were reactive and 17(8.5%) were non-reactive women. Overall mean age was 27.39±4.40 years. Most commonly noted risk factor were post-date 53(26.5%), anaemia 35(17.5%), premature rupture of membranes 28(14%) and pregnancy-induced hypertension 10(5%). Insignificant difference was observed in between Cardiotocography findings and risk factors of the women (p>0.05).

Conclusion: Significant change was seen in cardiotocography of clear liquor which needs more evaluation to rule out ongoing hypoxia.

Keywords: CTG, Intrapartum, Amniotic fluid. (JPMA 68: 1014; 2018)

Introduction

The presence of amniotic fluid stained with meconium is a subject of importance when considering intrapartum management. Studies have reported that on average 69% of new-borns pass meconium by 12 hours of age, but some foetuses pass meconium prior to birth as well.[1]

The presence of meconium in amniotic fluid and its relation to foetal compromise is a debatable topic. Some believe that it is a sign of impending or ongoing foetal deterioration, whereas other investigators believe that it is not associated with foetal hypoxia, acidosis or foetal distress.[2] Meconium stained liquor is an area of concern for both the obstetricians and paediatricians as it increases meconium aspiration syndrome, birth asphyxia, operative delivery and neonatal intensive care unit (NICU) admissions.[3-5]

Cardiotocography (CTG) is a monitoring tool which records changes in foetal heart rate (FHR) and its relation to uterine contraction.[6] Cardiotocography has got the advantage of being a non-invasive tool of monitoring foetal heart pattern, and its application has no contraindication. There is a significant correlation between pathological CTG and the state of the new-born evaluated by appearance, pulse, grimace, activity, and respiration (APGAR) score.[7] CTG is one of the reliable methods of monitoring the foetus in labour, in particular, pathological CTG predominantly indicates pre-existing foetal asphyxia.[7]

Obstetrics experience throughout the era showed that meconium passage is a possible threatening sign of foetal asphyxia,[8] while the reported incidence of meconium stained amniotic fluid is 1-18%.[9] Meconium staining of liquor has long been thought to be a conventional sign of foetal distress, but now CTG is an up-to-date practical method for foetal surveillance during pregnancy and labour.[10]

The current study was conducted to identify the relationship between colours of liquor with the trace of CTG, whether reactive or non-reactive, as well as to APGAR score.

Subjects and Methods

A cross-sectional study was conducted at Obstetrics and Gynaecology department, Dar-ul-Sehat Hospital, Karachi,

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Pakistan from June 2015 to March 2016 and comprised women in labour who delivered singleton babies and had pregnancies equal and beyond 37 weeks of gestation who were allocated to intrapartum monitoring by CTG. Institutional ethical approval was obtained and written informed consent was also taken from the study participants.

Women with twin gestation and homogenise calculation were excluded from the study, and so were those who received elective date for Caesarean section (CS) and went into labour prior to CS.

Women presenting with pregnancies that were complicated by hypertensive disorder, pre-existing maternal disease, ruptured membranes for more than 24 hours, complicated obstetrical history, intrauterine growth restriction (IUGR), post-dates were labelled as high-risk pregnancies.

Low-risk patients were monitored by a trained nurse having 10 years of experience and a resident medical officer (RMO). Patients' assessments was done by a senior registrar. The high-risk patients were also assessed by the senior registrar in detail, and the gynaecologist having 12 years of experience was also involved in their monitoring and assessment.

The status of the amniotic membranes, if ruptured whether artificially or spontaneously, colour and amount of liquor observed were recorded along with demographic details of the subjects like age, gestational age, parity status and mode of delivery. The gestational age was reconfirmed by previous, early and late ultrasound pelvis. The progress of labour was assessed by maintenance of partogram.

CTG was performed in every patient for 30 minutes in the left lateral position on admission as well as a monitoring tool in labour at an interval of more than 4 hours. The foetal heart transducer and uterine pressure transducers were applied and the readings were recorded. The CTG was classified as pathological or non-pathological based on the findings of examination of colour of liquor and the rest of pelvic examination in relation with CTG tracing. The meconium stained liquor was defined as yellowish green colour observed by medical staff which may indicate foetal distress meconium passed after birth but its presence in amniotic fluid is an area of concern while pathological CTG was defined as the presence of two or more deviation from normal CTG parameters or components. The appropriate method of delivery was then decided by the consultant, and the patient was managed accordingly. The APGAR scores were calculated at 1 and 5 minutes in all the new-borns. Risk factors were also noted.

SPSS 21 was used for statistical analysis. Cleaning and coding of the data was done prior to the analysis. Descriptive statistics was explored using mean and standard deviation for quantitative variables like age and gestational age, while frequency and percentages for quantitative variables like mode of admission, booking status, parity and gravida were determined. Parity was separately defined for conceived or aborted pregnancies.

Paired t-test was applied to see the difference of APGAR score at 1 minute and 5 minutes. Independent t-test was applied to see the difference of age and gestational age with CTG traces, whereas chi-square test was applied to see the association of CTG traces with general characteristics. Chi-square test was also applied to see the association between final CTG traces and CTG on admission with respect to clear final liquor colour and meconium stain. Univariate binary logistic regression was applied to assess significant relationships between dependent variables (CTG trace and colour of meconium) and independent variables. All the variables with $p<0.25$ in univariate analysis were selected for multiple logistic regression (LR) to calculate Adjusted Odds Ratio (AOR). Backward LR method was applied to develop the final model. $P<0.05$ was considered significant.

Results

Of the 200 subjects, 183(91.5%) were reactive and 17(8.5%) were non-reactive on CTG. Overall mean age was 27.39±4.40 years. Status of 192(96%) women was booked, while mode of admission was emergency department

Table-1: Comparison of CTG with demographic characteristics (n=200).

Variables	CTG		p-value
	Reactive n (%)	Non-Reactive n (%)	
Age, years	27.27 ±4.37	28.58 ±4.70	0.242†
Mode of admission			
OPD	80 (43.7)	6 (35.3)	0.502*
ER	103 (56.3)	11 (64.7)	
Booking Status			
Un Booked	8 (4.4)	0 (0)	0.379*
Booked	175 (95.6)	17 (100)	
Gravida			
Primigravida	70 (38.3)	7 (41.2)	0.813*
Multigravida	113 (61.7)	10 (58.8)	
Gestational age, date	38.74 ±1.13	38.64 ±1.28	0.74†
Gestational age, scan	38.62 ±1.12	38.84 ±1.27	0.439†

†Independent t-test applied, *Chi-square test applied
CTG=Cardiotocography; OPD: Outpatient department; ER: Emergency room.

Table-2: Comparison of CTG on admission and final CTG with respect to colour of liquor (n=200).

Final Liquor Color	CTG on admission	Final CTG		p-value†
		Reactive n (%)	Non-Reactive n (%)	
Clear	Reactive	129 (87.2)	19 (12.8)	<0.001†
	Non-Reactive	0 (0)	6 (100)	
Meconium Stain	Reactive	13 (37.1)	22 (62.9)	0.02†
	Non-Reactive	0 (0)	11 (100)	

All data presented as number (%)
†Chi-square test applied
CTG= Cardiotocography

Table-3: Regression analysis of Non-Reactive CTG compared with Reactive CTG (n=200).

	CTG					
	Non-Reactive n (%)	Reactive n (%)	OR (95% CI)	p-value	AOR (95% CI)	p-value
Color of Liquor						
Clear	6 (35.3)	162 (88.5)	Reference		Reference	
Meconium Stain	11 (64.7)	21 (11.5)	14.14 (4.73-42.2)	<0.01	9.35 (1.98-44.21)	0.005
Mode of delivery						
NVD	7 (41.2)	125 (68.3)	Reference		Reference	
FVD	1 (5.9)	2 (1.1)	8.92 (0.72-110.7)	0.08	10.08 (0.42-238.9)	0.15
VVD	3 (17.6)	21 (11.5)	2.55 (0.61-10.65)	0.19	0.7 (0.10-4.67)	0.71
CS	6 (35.3)	35 (19.1)	3.06 (0.96-9.69)	0.05	0.4 (0.06-2.58)	0.33
Deceleration						
Early	2 (11.8)	158 (87.3)	Reference		Reference	
Variable	11 (64.7)	11 (6.1)	79 (15.54-40.15)	<0.001	54.37 (7.71-383.2)	<0.001
Late	4 (23.5)	12 (6.6)	26 (4.37-158.66)	<0.001	11.26 (1.19-106.7)	0.03
NICU admission						
No	4 (2.5)	155 (97.5)	Reference		Reference	
Yes	13 (31.7)	28 (68.3)	0.056 (0.02-0.18)	<0.001	0.23 (0.04-1.23)	0.08

NVD: Normal Vaginal Delivery, FVD: Forceps Vaginal Delivery, VVD: Vacuum Vaginal Delivery, CS: Caesarean Section, NICU: Neonatal Intensive care Unit, OR: Odds Ratio, AOR: Adjusted Odds Ration
CTG= Cardiotocography.

(ED) in 114(57%) cases. Multigravida was found in 123(61.5%) while primigravida in 77(38.5%) patients. Insignificant difference was observed between CTG findings and demographics characteristics of the women (p>0.05) (Table-1).

Most commonly noted risk factor were post-date 53(26.5%), anaemia 35(17.5%), premature rupture of membranes (PROM) 28(14%) and pregnancy-induced hypertension (PIH) 10(5%) (p>0.05).

Most of the adequate amount of liquor was found to be predominantly higher in 167(83.5%) subjects, followed by scanty 25 (12.5%), and excess liquor 8(4%). Mode of delivery showed preponderance of normal vaginal delivery (NVD) 132 (66%), followed by CS 41(20.5%), vacuum vaginal delivery (VVD) 24(12%), and forcep vaginal delivery (FVD) 3(1.5%).

Meconium stained liquor was found in 46(23%) women whereas clear liquor was found in 154(77%) women. Grading of meconium stain liquor showed that 7(3.5%) had M1 grade, 18(9%) had M2, 17(8.5%) had M3, and 3(1.5%) had M4 grade. M2 grade staining was significantly higher in 16(47.1%) patients with reactive CTG compared to the patients with M3 10(29.4%), M1 7(20.6%), and M4 1(2.9%) (p=0.02), while adequate amount of liquor was significantly higher 157(85.8%) in reactive CTG compared to scanty 18(9.8%) and excess 8(4.4%) (p<0.001).

Comparison of CTG on admission and final CTG with respect to colour of liquor was noted (Table-2). Regression analysis showed that women with meconium stain colour liquor (AOR: 9.35; 95% Confidence Interval [CI]: 1.98-44.21), variable deceleration (AOR: 54.37; 95% CI: 7.71-383.23), and late deceleration (AOR: 11.26;95% CI: 1.19-106.74) were significantly more likely to have non-

reactive CTG (Table-3).

Mean APGAR score at 1 minute was 0.85±0.06, whereas at 5 minutes it was 0.76±0.05 (p<0.001).

Regression analysis of liquor colour showed that VVD(AOR: 3.35;95% CI: 1.07-10.46), CS (AOR: 3.75;95% CI: 1.42-9.88), and variable deceleration (AOR: 4.93;95% CI: 1.75-13.88) were significantly more likely to have meconium stain colour liquor (p<0.05).

Discussion

The findings of this study have shown higher prevalence of reactive CTG in patients having clear liquor both in artificial rupture of membrane (ARM) or spontaneous rupture of membrane (SROM), while nonreactive CTG were highest in patients with meconium stains. In particular, patients with grade two to three meconium stains had higher non-reactive CTG, while lowest result of reactive CTG among meconium stains were in those patients who had grade-4 meconium stain liquor. This could be due to false negative findings. On the other hand, the reliability of an abnormal pattern is much tougher to judge due to high chances of false positive findings.

A significant number of patients who had clear liquor had nonreactive CTG. A possible explanation could be hand or cord compression in 2nd or even 1st stage of labour. It is reported that CTG is used as a screening tool for foetal wellbeing in labour and has the ability to detect possible foetal compromise which may proceed to permanent neurological damage and foetal demise in utero.[11]

In our study, compared with NVD, meconium stain liquor colour was higher among women having FVD, VVD and CS. Similar findings were reported by other studies as well.[12,13] The preponderance of operative intervention in patients with meconium stained liquor has been reported by several studies.[14-16] Moreover, in accordance with other studies, our study has also shown higher rate of CS in meconium stained amniotic fluid.[15,13,17] In our study, due to the lack of monitoring facility by foetal scalp pH electrode, the rate of instrumental delivery and CS rate increased because abnormal CTG trace can be deceiving at times due to intra and inter observation variation in interpretation.

Women with variable and late deceleration were more in our study compared to early deceleration, and this variable and late deceleration was also more likely to have meconium stain liquor colour.

In addition, this study has also showed highest number of neonatal admission in NICU among patients with meconium stain. Most of them were kept for observation and started on intravenous antibiotics and shifted to mother side on getting stable. The reason for the high admission could be due to the strict policy of our hospital that they have to keep such neonates for observation. However, a Cochrane systematic review has revealed no significant role of antibiotics in the reduction of NICU admission, postpartum endometritis and neonatal sepsis.[18]

Actual hazard of meconium aspiration syndrome (MAS) secondary to academia inducing lung damage is much less and it was not checked up in intrapartum period due to limitation of unavailability of scalp pH.

In this study, risk factors were observed in more than half of the patients. Among these, anaemia, post-term pregnancies, PIH, diabetes, IUGR and oliguria were the most common risk factors. Somewhat similar findings were reported in a previous study.[19,20]

The finding of this study could be observed in the light of following limitations. First, this study was conducted in a single hospital among patients who mostly delivered in morning hours, while inclusion of patients presented in all shifts could have helped ascertain and included the distribution of all pregnant women who delivered singleton babies. Secondly, due to lack of the facility of foetal scalp sampling, which may lead to unnecessary intervention, the limitation of this invasive procedure can affect the mode of delivery and labour management. Lastly, we did not include patients as per statistical sample size calculation. Selecting number of cases on the basis of statistical formula could make this study more powerful. However, in spite of these limitations, this is the first local study of its kind which has determined the presence of variable and late deceleration at highest rate in meconium stained liquor.

Conclusion

Meconium stained liquor had its impact on APGAR score. The trace of CTG as late and variable deceleration was mostly observed. Moreover, significant change was also seen in CTG of clear liquor which needs more evaluation to rule out ongoing hypoxia.

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Conflict of Interest: None.

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